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Economic Convergence and Structural Change: the Role of Transition and EU Accession

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Abstract: This paper analyses the speed and patterns of economic convergence in new EU Member States from Central and Eastern Europe during transition and the first years of EU membership. After a brief discussion of measurement and data issues, the paper provides stylised facts on growth and convergence in Europe, and explores various convergence measures proposed in the growth literature. It employs several analytical approaches in order to reveal convergence speed and patterns: univariate growth regressions, multivariate econometric analysis, including the testing of convergence models and running different growth regressions. The aim is to look at various aspects of convergence processes by using alternate approaches and then, by putting those together, to seek common and distinct features. We confirm that the one-off direct negative effects of the crisis on GDP growth were considerably stronger in the case of NMS. The growth patterns were interrupted and the convergence process slowed down. The paper underlines considerable, sometimes even increasing, heterogeneity of growth, pointing more generally to uneven economic convergence within the EU. This concerns not only the lasting differences between the NMS and the rest of the EU, but also significant dissimilarities between the growth patterns among individual countries within each of these subgroups.

Introduction

This paper aims to analyse the speed and patterns of economic convergence (cohesion) in countries of Central and Eastern Europe since the start of their economic and political transition in 1990. We focus on the period before, but especially after the EU accession, including the assessment of impacts due to the recent crisis. After a brief discussion of measurement and data issues, the paper explores various convergence measures proposed in the growth literature (Barro and Sala-i-Martin, 1992, 1995; Islam, 2003; Martín and Sanz, 2003; Young, Higgins and Levy, 2004; Monfort, 2008). We experiment also with alternate datasets and convergence indicators when assessing convergence at the country-wide level. Furthermore, we evaluate the impact of the recent crisis on the speed and patterns of convergence in countries of Central and Eastern Europe which were hit particularly hard by the crisis. The paper employs some of the widely used analytical approaches that draw on well-established avenues in economic theory and applied analysis. These start from the simplest univariate growth regressions and then move on to multivariate econometric analysis, including the testing of various convergence models and running different growth regressions. Each of these approaches has its strengths and weaknesses as well as limits to its analytical potential and it would be naïve to expect that any of them alone would provide a realistic picture of these complex processes. The aim is to look at different aspects of the convergence process by using different approaches and then, by putting them together, to seek for explanations of common features and underlying factors.

Data and country coverage

Our analysis focuses on the ten new EU Member States from Central and Eastern Europe that joined the EU in 2004 (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia) and in 2007 (Bulgaria and Romania) respectively, all abbreviated as NMS or EU-10. Occasionally, we make a comparison with the whole EU-27 and the rest of the EU (EU-17). The main convergence indicator is Gross Domestic Product (GDP) and GDP per capita, respectively, as published by the national statistical offices (before 1995) and by Eurostat. We discuss the merits of alternate convergence results using GDP data at domestic constant prices (real growth), GDP converted from national currency with Purchasing Power Parities (PPPs), GDP converted with market exchange rates and discuss the merits and pitfalls of the various results. Last but not least, we assess also the effects of the recent crisis on convergence and divergence in Europe.[1]

Economic growth, convergence and divergence

The real economic convergence is about diminishing differences in economic development levels or about closing the welfare gaps between countries or regions. This implies that we speak about convergence if countries (regions) at lower economic development level (usually approximated by GDP per capita at PPP) grow faster than the more developed ones. Though the standard neoclassical growth theory predicts real convergence of open economies, the new growth theory which allows for increasing returns to human capital does not exclude economic divergence either. At the same time, foreign trade and direct investments may enable technology transfer and spillovers, especially when cross-border barriers are removed and economic integration progresses. These latter convergence channels have been of particular relevance for the new EU Member States from Central and Eastern Europe (NMS) during their transition and EU accession integration processes. Furthermore, Gerschenkron's 'advantage of backwardness' with its possibilities to imitate (which as a rule is easier than to innovate) can additionally stimulate the economic catching-up of less advanced countries.

There are a number of empirical research papers dealing with convergence in Europe. ESE (2000) finds evidence of a tendency for absolute (unconditional) long-run convergence in post-war Europe both concerning Western and Eastern Europe. Wagner and Hlouskova (2001), Matkowski and Próchniak (2004), and Borys, Polgár and Zlate (2008) analyse real convergence in CEE countries prior to EU accession and the prospects thereafter. Rapacki and Próchniak (2009) and Szeles and Marinescu (2010) study empirically the process of real convergence of CEE countries after accession and the role of EU integration for the acceleration of this process. Halmai and Vásáry (2010) analyse the interplay of real and nominal convergence in NMS during the catch-up process. All these studies do find evidence of an ongoing process of real economic convergence. In particular, Rapacki and Próchniak (2009) conclude that EU enlargement contributed to the speeding-up of economic growth of the CEE countries and their real convergence to the richer EU countries. In turn, Szeles and Marinescu (2010) find evidence of both absolute and conditional convergence in CEE countries.

Nevertheless, the economic convergence cannot be guaranteed; 'convergence is anything but automatic' – policies, institutional arrangements and country-specific conditions such as the geographic location matter as well (Milanovic, 2011; Rodrik, 2011; Easterly et al., 1993; Easterly,

[1] Unless stated otherwise, all data in this paper have been extracted from the wiiw Annual Database which is based on Eurostat and national statistics, complemented by own estimates when necessary.

1995).[2] On a more abstract level, Acemoglu, Robinson and Verdier (2012) argue that the 'diversity of institutions' may reinforce asymmetric equilibria and that 'all cannot be like Nordics' or, to paraphrase more recent discussions, 'all cannot be like the Germans' (Centre for European Reform, 2013). Still, barring some extraordinary events, such as the 'transitional recession' of the early 1990s or the recent financial crisis (2008-2009), the prevailing longer-term empirical evidence seems to support the convergence hypothesis: 'economies converge at a speed of two per cent per year' (Young, Higgins and Levy, 2004 quoting Sala-i-Martin, 1996). Indeed, Barro and Sala-i-Martin (1995, p. 413) concluded that the speed of convergence in a number of different contexts (US federal states, Japanese prefectures and European regions) was rather similar – around 2-3% per year. The recent paper investigating growth effects of EU Cohesion Policy during the past decade has found that 'EU countries are converging. Regions in Europe are also converging. But, within countries, regional disparities are on the rise' (Marzinotto, 2012). Another recent study which analyses patterns and effects of German-CEE supply chains has found that those NMS which are closely linked to the German trade and investment clusters (the Czech Republic, Hungary, Poland and Slovakia) have enjoyed faster income convergence thanks to technological spillovers and efficiency gains (except Hungary – see IMF, 2013).

On the other hand, other studies find that 'the convergence of EU regions is actually extremely limited' (Monfort, 2008). On the global level, there has been an extensive discussion whether there has been income convergence, the respective impacts of globalisation or whether there has been absolute income convergence of developing countries at all (Dollar and Kraay, 2001; Dufrénot et al., 2003). Marzinotto (2012) explains the contradictory empirical evidence regarding convergence or divergence by stating that 'macroeconomic simulations produce better results than empirical tests'.

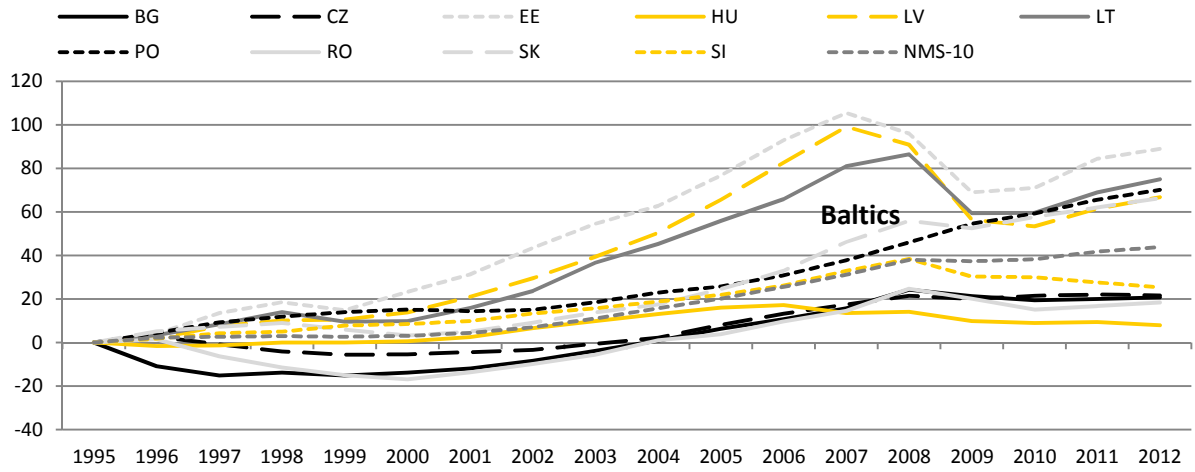
Table 1. Average annual real GDP growth rates, 1995-2012, in %

	95-00	00-05	05-10	95-08	08-12	95-12
BG	0.23	5.49	2.69	3.63	-0.77	2.58
CZ	1.84	4.09	2.70	3.49	-0.19	2.61
EE	6.68	7.94	0.00	6.64	-0.92	4.81
HU	2.94	4.16	-0.18	3.10	-1.26	2.06
LV	5.20	8.23	-0.68	6.46	-2.94	4.17
LT	4.54	7.79	1.02	6.30	-1.48	4.42
PO	5.41	3.08	4.72	4.66	3.03	4.27
RO	-0.38	5.72	2.51	3.66	-1.23	2.49
SK	3.40	4.91	4.70	5.08	1.19	4.16
SI	4.33	3.63	1.79	4.31	-2.14	2.75
NMS-10	3.38	4.31	3.09	4.29	0.68	3.43
EU-27	2.84	1.80	0.90	2.32	-0.23	1.71
Difference (NMS-EU), convergence rate, in pp	0.54	2.51	2.19	1.97	0.91	1.71

Source: wiiw Database and Eurostat; own calculations.

[2] In fact, some authors are rather sceptical regarding the economic convergence of CEE transition countries even during the pre-crisis period (Podkaminer, 2013). There are a number of examples of countries/regions where convergence did not occur even after decades (North-South Italy, East-West Germany, etc.).

Figure 1. GDP growth convergence, index 1995=100, differences to EU-27 average, in pp



Source: wiiw Database and Eurostat; own calculations.

Some of the inconclusive findings regarding economic convergence may result not only from different growth theories and underlying assumptions, but relate also to measurement problems, varying model specifications, regional/country coverage and different time periods. We will address some of these technical and methodological issues below. First, Table 1 provides an overview of GDP growth performance in the NMS and EU-27 during the whole period 1995-2012 and in individual sub-periods. On average, the NMS' growth performance (weighted average using PPP weights) has not been all that impressive: the growth differential with respect to the EU-27 has been around 1.7 percentage points during the 1995-2012 period.[3] Only during the 2000-2005 and 2005-2010 sub-periods was the NMS-EU-27 average growth differential higher than 2 pp. Also in the1995-2008 sub-period (i.e. before the recent crisis), the (weighted) NMS average growth differential against the EU-27 average was close to 2 pp. During the crisis period (2008-2012), the NMS-EU growth differential slipped just below 1 pp, being driven mainly by positive growth rates in Poland and Slovakia. At the same time, the current crisis hit most countries in the NMS region hard: the majority of countries recorded negative GDP growth in the period 2008-2012 and were falling behind the EU average; the sole exceptions being the Czech Republic, Poland and Slovakia. NMS growth patterns thus differ not only across individual sub-periods, but in individual countries as well. Thus, for example, Hungary and Latvia recorded negative GDP growth during 2005-2010 (and Estonia's GDP stagnated) following a boom five years before (Table 1). Nevertheless, the process of NMS GDP convergence continued even during the crisis period – albeit at a slower pace (we shall return to this issue later with additional econometric evidence).

Prior to joining the EU, the countries of Central and Eastern Europe went through a painful process of economic transformation from centrally planned to market economies. In all these countries, the start of transition was marked by a deep transformational recession which in some cases wiped out the results of years and even decades of growth and catching up. The period of the transformational recession, its causes and the determinants of its duration and depth have been widely studied and reflected in the economic literature.[4] Joining the EU was a strong push for economic convergence to

[3] In the first half of the 1990s, the transformational recession resulted in a drop of GDP in the NMS (see, e.g. Havlik, 2012; Cuaresma et al., 2012).

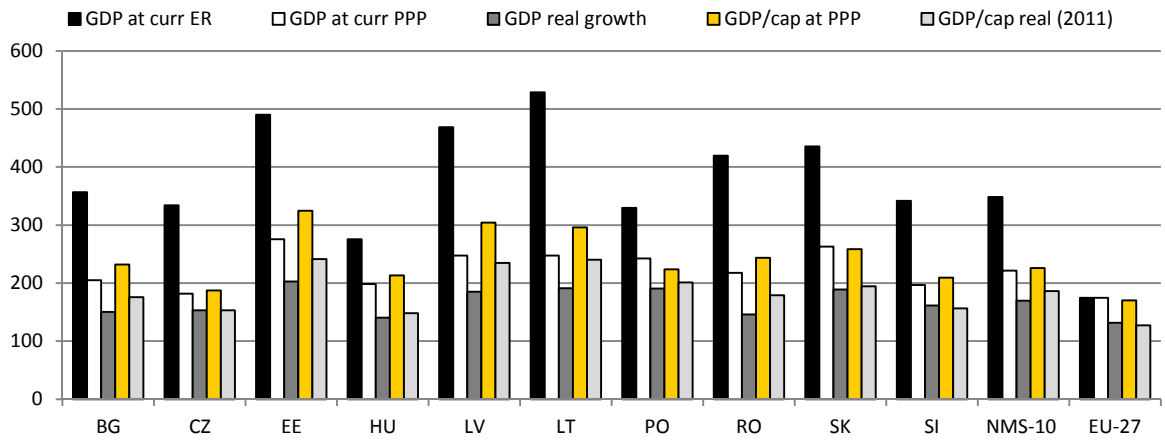
[4] See, among others, Bennett, Estrin and Urga (2007); Godoy and Stiglitz (2006); Falcetti, Lysenko and Sanfey (2006); Fidrmuc and Tichit (2009); Hare and Turley (2013); Kornai (2006); Rusinova (2007).

strengthen in this part of the continent. Absolute real economic convergence within the EU has been a well-established fact which is documented and empirically verified in the economic literature. As a general trend, it has continued uninterruptedly since the inception of the Community and has endured every new round of EU enlargement, including the biggest ever eastern enlargement of 2004-2007, which increased the number of EU Member States from 15 to 27.[5]

The stylised facts provided in Table 1 and Figure 1 above indicate that the NMS catching-up rate was unspectacular over the whole period 1995-2012: less than 2 pp per year on average. Nevertheless, cumulated over the whole period of 17 years (1995-2012), NMS GDP gained on (PPP-weighted) average more than 40 pp compared to the EU-27 average, with the Baltic States (and Poland) gaining more than 60 pp (despite the fact that the Baltics were hit disproportionately hard by the crisis during 2007-2009 – see Figure 1). In contrast, Hungary's and Romania's growth performance has been particularly disappointing, with Hungary diminishing the gap by only 8 pp and Romania by less than 20 pp (see also Cuaresma et al., 2012). In general, the NMS' catching-up patterns differed considerably across individual countries and the process of economic convergence cannot be taken for granted in general (again, we shall return to these issues below by providing additional econometric evidence).

Figure 2 presents several alternative growth indicators which have been used in the growth and convergence literature (the latter frequently without proper definitions).[6] Differences (and therefore also conclusions regarding the speed of convergence) in individual growth measures are quite large. The three widely used alternative growth measures (based on GDP at current exchange rates, current PPPs and real growth rates) differ by a wide margin. The latter indicator (based on cumulated real growth rates of GDP) indicates the lowest growth and convergence speed. The two former indicators suggest higher growth rates as they are affected by different rates of national currency appreciation against the euro or the US dollar (exchange rate) and/or by changes in the structure of the consumer basket (PPP).

Figure 2. Alternate GDP growth measures, 1995-2010 (index 1995=100)



Notes: ER=current exchange rate; PPP=current purchasing power parity.

Source: Authors' calculations based on wiiw Database and Eurostat.

[5] For an overview see Rapacki and Próchniak (2009) and ESE (2000).

[6] See, for example, World Bank (2012).

Another facet of the convergence discussion relates to the differences between GDP growth rates and GDP per capita growth rates. These differences are important (yet frequently ignored) especially in the case of NMS owing to their declining (in several countries even sharply declining) populations.[7] Figure 2 shows also alternate GDP (and GDP per capita) growth measures which illustrate these differences, in particular regarding the NMS where nominal and real developments widely differ owing to currency appreciation and/or rapid structural change. The first set of bars in Figure 2 illustrates the (high exchange rate-based) nominal growth, the highest in countries with the largest nominal appreciation of the domestic currency (Baltics, Slovakia and Romania). Measured at current PPPs (the second set of bars in Figure 2), the growth of GDP is considerably lower since the effect of currency appreciation is largely eliminated yet the structural change – reflected in varying domestic and EUR-based inflation rates and in the composition of baskets used in benchmark PPP comparisons (Eurostat) – lifts the estimated PPP-based GDP growth rates. A more appropriate measure of growth – based on domestic real GDP growth rates – is shown in the third set of bars in Figure 2 (the corresponding average growth rates are shown in Table 1).[8] Last but not least, it is useful to compare also GDP per capita growth rates – the latter being usually higher – owing to declining populations in a number of NMS (especially in the Baltics, Bulgaria and Romania). The choice of a particular growth indicator thus matters a lot when assessing the speed of economic convergence.

Absolute convergence in the EU and NMS

Apart from the above-mentioned conceptual and statistical measurement problems, the standard growth literature distinguishes between two types of economic convergence: sigma-convergence and beta-convergence (Barro and Sala-i-Martin, 1995). Beta-convergence (usually signalling the above-mentioned 'speed of convergence') means that poorer countries are growing faster than richer ones and therefore are 'catching up'.[9] Sigma-convergence represents a reduction in the dispersion of per capita GDP levels among different countries.[10] In the following section we discuss again both data and measurement problems related to various convergence measures.

The real (absolute) convergence hypothesis implies a systematic tendency for poorer countries to grow faster than the rich ones. It is estimated on the basis of a univariate cross-country regression of per capita income growth:

$$[y(t)-y(0)] = \alpha+\beta y(0)+\varepsilon \quad (1)$$

where: y(t) resp. y(0) is a vector of logarithms of per capita income in country i (i = 1...n) in year t and 0 respectively, ε denotes an error term.

A negative sign of the estimated coefficient β indicates absolute ('beta') convergence, meaning that countries at lower initial income level grow faster. Another widely used convergence indicator is

[7] Newly released population census data for 2011 revealed substantial population declines (up to 10% compared with previous estimates, mostly due to outward migration) particularly in the Baltic States as well as in Bulgaria and Romania. For the sake of comparability, we limited the time span in Figure 2 by the year 2010.

[8] More on real GDP comparisons see Fink and Havlik (1989) and Feenstra, Inklaar and Timmer (2012). The average growth rate (for both NMS and EU-27) is affected by weighting. Here we use PPP-based GDP as weights; the NMS average is therefore affected by fairly high GDP growth in Poland which has the largest economy among the NMS.

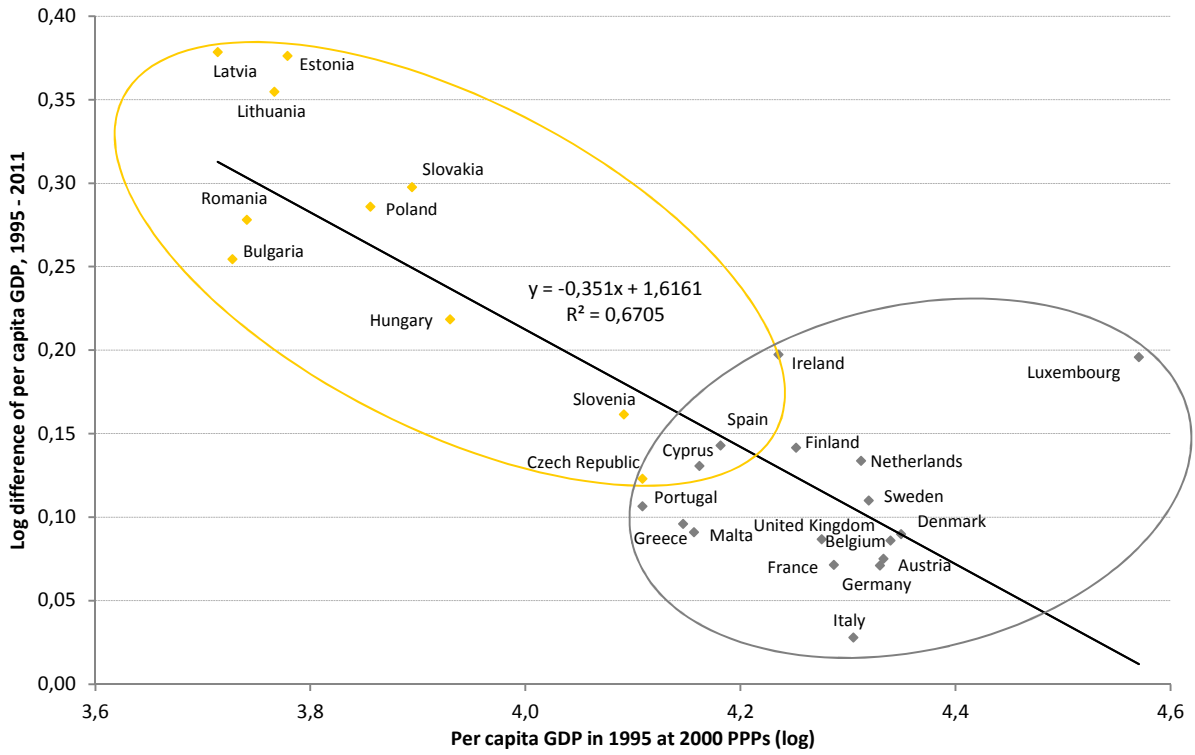
[9] Beta-convergence can be absolute or conditional, the latter meaning adding other variables than the starting level of per capita GDP in growth regression (e.g. capital endowments, institutional factors, etc.).

[10] Beta-convergence is necessary but not a sufficient condition for sigma-convergence – see Young et al. (2003); Monfort (2008). Moreover, some authors use also 'gamma-convergence' which is used in the analysis of asymptotic behaviour of variational problems. In our context, gamma-convergence is measured by Kendall's index of rank concordance (Boyle and McCarthy, 1999).

'sigma'-convergence which measures the tendency of per capita incomes across a group of countries to become more homogenous (for example in terms of declining standard deviations) over time (Barro and Sala-i-Martin, 1995 and ESE, 2000).

Figures 3 and 4 present empirical results on the incidence of beta- and sigma-convergence within the EU, for the period 1995-2011, based on the most recent available data. In the main this most recent assessment supports the findings of earlier related studies. The scatter diagram presented in Figure 3 and the fitted trend line indicate a strong inverse relationship and between starting per capita GDP levels and subsequent growth for the period 1995-2011 and a good fit to the observed data. These results can be taken as providing evidence which supports the absolute unconditional convergence within the EU-27 in this period. In accordance with the parameters of the fitted regression, the implied average rate of absolute convergence among the 27 economies in this period has been about 2 per cent per annum. This result is again entirely in line with the above-mentioned '2% rule' of convergence, detected already in the very first tests of the convergence hypothesis (see, for example, Mankiw, Romer and Weil, 1992). Respectively, the time necessary to move half way to the balanced growth path corresponding to this speed of convergence is around 35 years.[11]

Figure 3. Beta-convergence in the EU, 1995-2011 (logarithms of per capita GDP in euro, 2000 prices and PPPs)



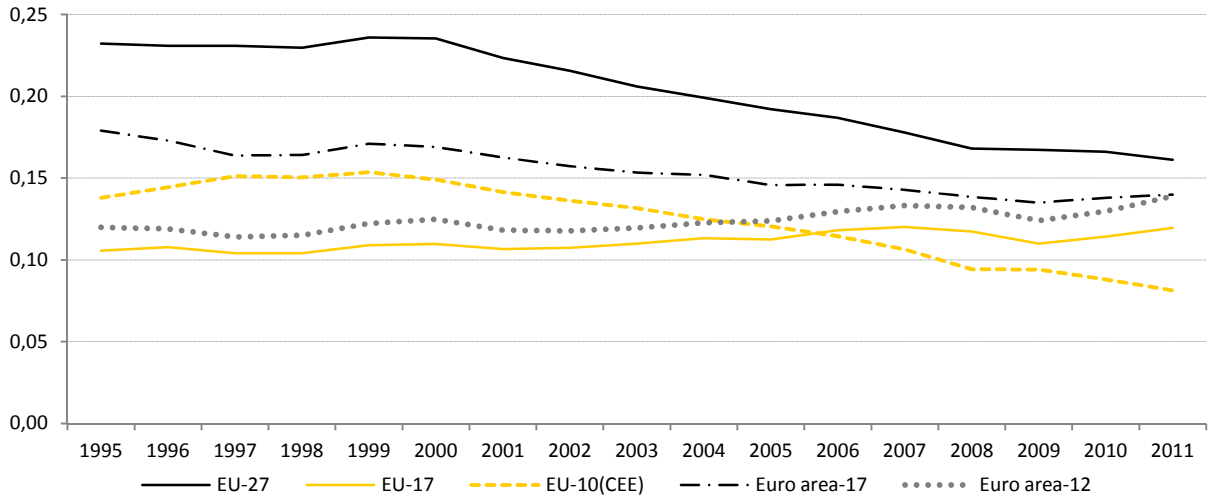
Source: Eurostat; authors' calculations.

[11] The implied speed of convergence (β) is calculated from the identity: 1 - e- βT = b, where T stands for the duration of the period covered by the regression. Note that in the framework of the Solow growth model β refers to the speed of convergence to steady state and not necessarily to the speed of convergence in per capita incomes (see below). The interpretation of β is as follows: each year the economy moves β% of the remaining distance towards the steady state. E.g., the time τ it takes to move half way to the balanced growth path is calculated as: τ = - ln(0.5)/β.

Figure 3 also illustrates a characteristic, namely, that the NMS are (still) a 'club' of their own: on average this group of countries still (in 1995) lagged considerably behind the EU-17 in terms of the level of their per capita incomes. In the meantime (year 2013), the estimated average per capita GDP level in the NMS has reached about 65% of EU average (as compared with 45% in 1995) while the Czech Republic, Estonia, Slovakia and Slovenia already have the same (or even higher) per capita income levels than Greece and Portugal (see Annex Table 1). This feature, as will be shown further below, is associated with a number of specific features in their growth – more generally, economic – performance.

Importantly, as can be seen from the historical statistics presented in Table 1 above, the process of catching up between the NMS and the EU-17 (and hence absolute real convergence within the EU-27) has continued also during the years of the current crisis, albeit at generally lower rates of GDP growth.

Figure 4. Sigma-convergence in the EU, 1995-2011 (standard deviations of logarithms of per capita GDP)



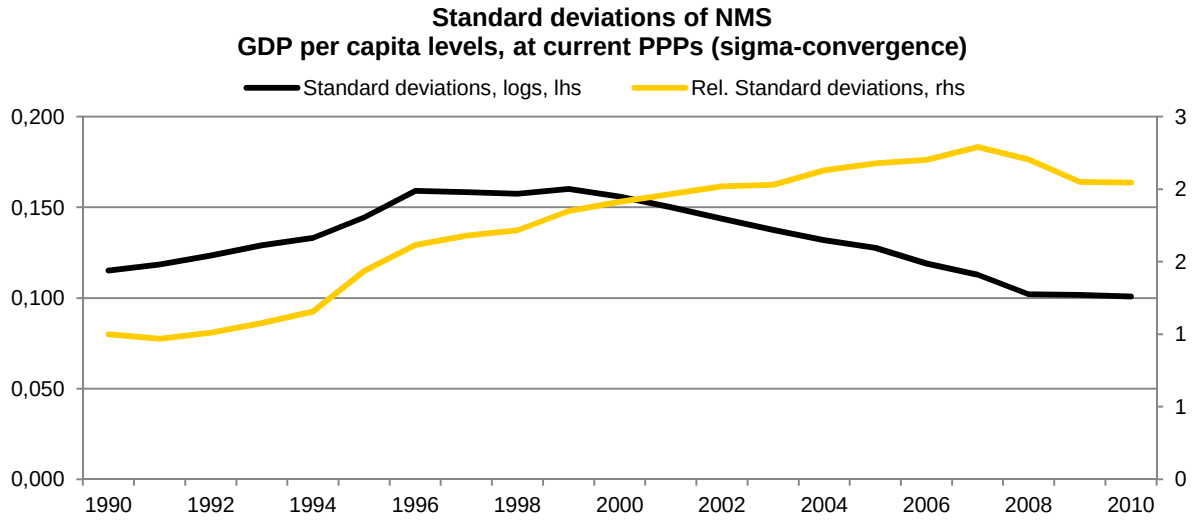
Source: Eurostat; authors' calculations.

Figure 4 illustrates the evolution of sigma-convergence within the EU-27 since 1995 for five subsets of EU countries. Overall, the main trend during this period has been towards a declining standard deviation of per capita incomes within the EU-27, especially in the period after 2000. Within the NMS (EU-10) economies, the pattern of the dispersion of per capita incomes has been uneven: an initial rise in the second half of the 1990s was reversed in the following decade with a steady decline ever since. Within the current euro area (17 countries), the general trend towards narrowing of differences in per capita GDP persisted but there has been a slight reversal since the start of the current crisis. At present the EU-10 is the subset of countries within the EU that features the most pronounced sigma-convergence.[12]

[12] The subset of countries that do not fully fit into this pattern are the group of the 12 euro area countries (founding states plus Greece) and the group that we denote as EU-17 in this paper (current EU members less CEE). In both these subsets of countries the general trend – somewhat paradoxically – has been towards a growing dispersion of per capita incomes and this has been especially pronounced since the start of the current crisis. This outcome is an indirect indication that despite the proclaimed objectives, the institutional arrangements within the euro area did not always promote convergence among the participating countries.

Additionally, Figure 5 shows diverging trends in alternate sigma-convergence indicators for the NMS after EU accession (measured either by standard deviations of per capita PPP-based GDP levels, or by relative standard deviations of this indicator compared to the starting level in 1990).[13] One can see that until about 2007 the relative income disparities among NMS was growing whereas the opposite (e.g. income convergence) occurred thereafter. Sigma-convergence based on logs of standard deviations shows a declining trend since the early 2000s. In the past three years (after 2008), however, both indicators suggest that NMS income convergence came to a standstill.

Figure 5. Sigma-convergence of NMS, 1990-2010



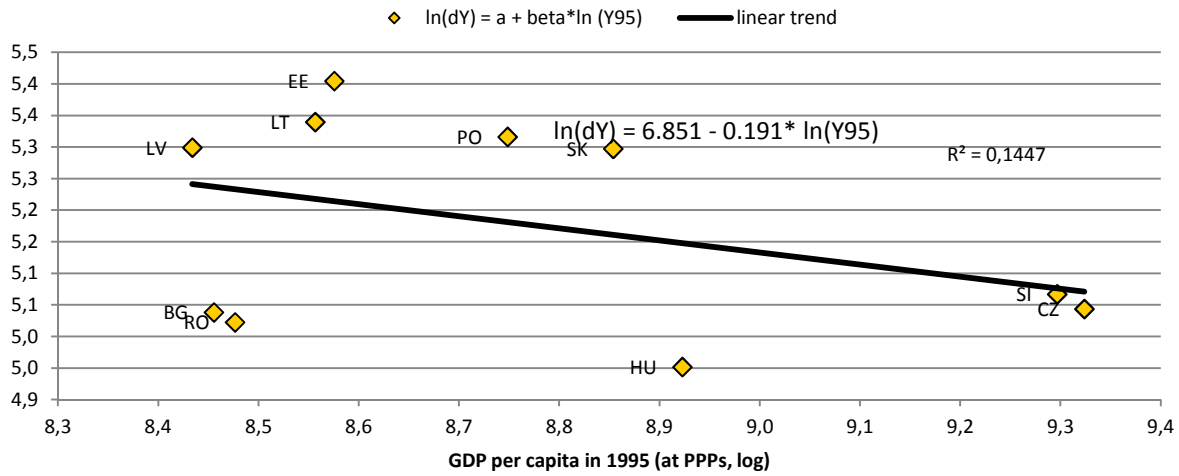
Source: wiiw Database and Eurostat; own calculations.

Next, Figure 6 provides some additional evidence for (unconditional) NMS beta-convergence, this time for the period 1995-2012. As expected, the regression parameter has a negative sign (countries with lower initial development levels tend to grow faster), but the relationship is rather weak. Indeed, the group of Baltic countries at lower starting income level (PPP-based GDP per capita in 1995) tend to grow faster though this does not hold to the same extent for Bulgaria and Romania. The Czech Republic and Slovenia – both among the more developed NMS – are converging as expected, that is their average real growth rates in the period 1995-2012 were lower than, e.g., in Poland and Slovakia (see also Table 1).[14] Obviously, the convergence processes are more complex ('conditional') and more factors have to be taken into account. The usual approach is to include additional explanatory variables into growth regressions and use panel estimation methods to reflect the diversity of growth patterns (see below).

[13] There are other measures of sigma-convergence – see, for example, Monfort (2008).

[14] GDP growth (1995-2012) in this equation is measured in 'real terms' (and not per capita) in accordance with data in Table 1. Obviously, estimates are affected by the initial GDP per capita level at PPP (Y95) which appear extremely low for Bulgaria and Romania.

Figure 6. Beta-convergence of NMS during 1995-2012 period



Source: wiiw Database and Eurostat; own calculations.

Conditional convergence in the EU and NMS

In a next step we expand the scope of convergence assessment by looking into conditional convergence within the EU. The above-discussed initial neoclassical interpretation of absolute convergence is rather restricted. Besides, as pointed out by Mankiw, Romer and Weil (1992), 'the Solow model does not predict convergence; it predicts only that income per capita in a given country converges to that country's steady-state value. In other words, the Solow model predicts convergence only after controlling for the determinants of the steady state, a phenomenon that might be called "conditional convergence".' To this end, the conditional convergence hypothesis implies that for countries to converge to the same growth path, they have to be similar. In the more frequent general case when they are not, one needs to control for structural differences among countries in order to observe the negative relationship between actual growth rates and the initial level of per capita income.

With the advance of economic theory, the concept of real convergence has also been enriched with the hypothesis that the closing of the technological gap between the poor and richer countries is among the key factors for a catch-up process. This idea is embodied in the models of conditional real convergence which relate the process of reduction in per capita income differentials across a group of countries with a set of 'conditioning variables' (Mankiw, Romer and Weil, 1992). In contrast to the absolute convergence hypothesis, which is strictly derived from the neoclassical growth model, conditional convergence can be embedded within a broader class of theoretical models including both neoclassical but also endogenous growth models. In the framework of the latter, a sustained catch-up process is conditional to the closing of the technology gap between less and more developed countries.

Conditional real convergence is usually tested with different versions of the following basic regression:

$$[y(t)-y(0)] = \alpha + \beta y(0) + \gamma X + \varepsilon , \quad (2)$$

where – in the neoclassical theoretical framework – X is a vector of variables that sustain the economy in a steady state; y(t) resp. y(0) represent logarithms of per capita incomes in year t resp. 0

as in equation (1) above. In the context of new growth theories, the set of conditioning variables X should reflect technological progress, both strictu sensu but also in the sense of the existence of an enabling macroeconomic and institutional environment which may be supporting in the closing of the income gap. As above, also the regression is tested on a dataset covering a group of countries which are subject to the convergence test.

Equation (2) is in principle derived from different formal growth models. To the extent that the actual specification of equation (2) follows such a derivation from a model embedding the hypothesis of conditional convergence, the regressions of type (2) are sometimes divided into 'formal models' (which strictly follow a formal derivation) or 'informal models', if they contain ad hoc terms which do not follow directly from a formal derivation.

The assumptions regarding the structure of the error term give rise to other classes of models. Thus the assumption of the absence of idiosyncratic, time-variant components of the error term (which is equivalent to ignoring both country-specific and time-variant effects as done in the univariate analysis presented in the previous section) leads to the application of formal or informal cross-section techniques. By contrast, the assumption of an idiosyncratic, time-variant component of the error term entails a switch to time series or panel approaches.

The literature abounds with many different approaches to testing conditional convergence (see, for example, Islam, 2003; ESE, 2000). The present paper uses (for the same reasons as those spelled out in the previous section) the so-called informal cross-section growth regressions. These models refer to different specifications, not necessarily formally derived from a particular growth model, but which include explanatory variables associated with technological progress. Such growth regressions are often referred to as 'Barro regressions' after Barro (1991), who was the first to apply such a technique.

In practical terms, the choice of both the model and the set of conditioning variables depends on the key assumptions regarding the nature of the economic processes in the group of economies we analyse, as well as on the availability of statistical data characterising these processes. As noted above, the conditioning variables should reflect the presence of an environment supporting the closing of technological and income gaps. This set typically includes variables such as capital accumulation, financial system development, FDI, imports of technological products, educational attainment, measures of macroeconomic stability, trade openness, measures of institutional development, etc.

The choice of such a more informal specification is to a large degree determined by the available statistical data for the testing of the model. Equation (2) was estimated as a cross section over the period 2000-2011. We use the following set of conditioning variables:[15] log percentage difference of real ULC; log difference of gross domestic savings (in % of GDP); log difference of gross domestic plus foreign savings (in % of GDP); log percentage difference in the share in world exports.[16] The dependent variable [y(t)-y(0)] is the log difference of per capita GDP at 2000 PPS. This regression should test to what extent the observed income convergence within the EU was related to the effect of these selected conditioning variables.

[15] A much wider set of conditioning variables has been tested for the equation but in most cases the estimated coefficients were not statistically significant. The final selection reflects independent variables that were estimated with statistically significant coefficients or at least with signs that correspond to the theoretically expected ones.

[16] Here, as well as in the subsequent econometric exercises, it was not possible to include in the estimated equations the innovation performance variable discussed in the previous section as the data only cover part of the period under consideration.

The estimation results shown in Table 2 indicate that within the set of the selected conditioning variables, real convergence within the EU-27 was mostly conditional on the international competitiveness of the catching-up countries.[17] The two conditioning variables which appear to be most closely associated with the catch-up process are the changes in real ULC and in export performance, both of which are indicative of rising international competitiveness (see also IMF, 2013 which provides additional evidence for selected NMS which participate in German trade and investment clusters).

Domestic savings (as well as the sum of domestic plus foreign savings) and labour input were estimated with the correct (expected) signs but their coefficients in most cases were not statistically significant. The coefficient on domestic savings was only estimated as significant in versions of the equation which exclude export performance (equation 2). Somewhat surprisingly (and in contrast to similar studies for other groups of countries such as the four 'German cluster NMS' analysed in IMF, 2013), in none of the equation versions that were tested, FDI was estimated to be a statistically significant conditioning variable.

Table 2. Estimation results for conditional real convergence within the EU-27, 2000-2011 (OLS estimations). Dependent variable: Log difference of per capita GDP at 2000 PPS, 2000-2011.

Variables	Equations			
	1	2	3	4
Log of GDP per capita in 2000 in 2000 PPS (y0)	-0.215***	-0.381***	-0.193***	-0.261***
	(-3.263)	(-11.266)	(-2.869)	(-5.124)
Log percentage difference of real ULC, 2000-2011	-0.388*	-0.630***		-0.628**
	(-1.727)	(-2.653)		(-1.955)
Log difference of gross domestic savings as % of GDP, 2000-2011	0.111	0.258***	0.068	
	(1.566)	(4.735)	(0.980)	
Log difference of gross domestic plus foreign savings as % of GDP, 2000-2011				0.276*
				(1.705)
Log percentage difference in share in world exports, 2000-2011	0.244***		0.301***	
	(2.816)		(3.604)	
Constant	1.059***	1.862***	0.940***	1.367***
	(3.326)	(11.539)	(2.902)	(7.885)
Observations	27	27	27	27
R2	0.919	0.889	0.908	0.806
R2 adjusted	0.904	0.875	0.896	0.781
Implied speed of convergence (β)	1.77	2.93	1.61	2.11
Implied time to move half way to the balanced growth path (τ), years	39	24	43	33

t-statistic in parentheses.

In accordance with the parameters of the estimated equations, the implied average rate of conditional convergence among the EU-27 economies in this period in the different versions of the equation (versions 1-4 in Table 2) range from 1.6 to 2.9 per cent per year, but in most cases it is again around 2 per cent. It is not much different from the estimated speed of absolute (beta – β) convergence as indicated above. Moreover, values close to 3 per cent refer to the equation versions excluding export performance, one of the key variables conditioning the catch-up process. Note that in the case of the tested model of conditional convergence the speed of convergence β refers both to the speed of convergence to steady state (in the framework of the Solow growth model) and to the

[17] Admittedly, the number of observations is very low, undermining to some extent the reliability of the results.

speed of real convergence. Put differently, according to our empirical estimations, convergence to steady state would at the same time be accompanied by convergence in per capita incomes.

Summing up the outcomes of the absolute and conditional convergence tests, one could conclude that convergence has been underway within the EU-27 during the past decade. The average speed of convergence has been in the order of 2 percentage points per annum. International competitiveness has been one of the factors bolstering convergence but it has not been a key determinant. It appears that – at least during the period we test – a conventional catch-up process associated with significant differences in the starting levels of per capita incomes has dominated real convergence within the EU. Furthermore, the convergence processes have been rather uneven, with some countries (such as Hungary) converging more sluggishly – if at all.

Table 3 presents estimation results of another informal cross-section growth regression of the sort often applied in empirical studies. In these regressions, we de facto step aside from the conditional convergence hypothesis and regress the average rate of real GDP per capita growth on a set of variables that are among the 'usual suspects' as regards the theoretical potential determinants of growth discussed in the literature. This type of specification can be obtained starting from growth models defined with a conventional production function, takings logs, linearising around the steady state and applying assumptions on the error term. In this case the assumptions regarding the error term are the same as when applying cross-section models to test conditional convergence, namely, the absence of country-specific and time-variant effects. The specification includes variables (taken as period averages) such as: net inflow of FDI, change in real ULC, change in the share in world exports; annual change in private debt; annual change in total (government + private) debt; annual change in total liabilities of the banking sector.[18]

With these caveats in mind, the estimation results shown in Table 3 provide some additional insights into the patterns of growth in the EU in this period. In the first place, the results do confirm the importance of international competitiveness (approximated by changes in real ULC and export market shares) for the growth of individual EU countries. In addition, these growth regressions provide evidence of the role of FDI as a determinant of growth in this period. Importantly, they also highlight the association between economic growth in the EU economies and the rise in their indebtedness. The latter is evidenced in the statistically significant estimates with three different measures of debt: private debt; total (government + private) debt; and total liabilities of the banking sector.

Cross-section growth regressions suffer from a number of methodological problems. Mankiw (1995) points to three main types of problems: simultaneity problem (difficulties in separating causes and effects); multicollinearity problem (the correlation among the determinants of growth); and degrees-of-freedom problem (there can be many plausible hypotheses, which can exceed the number of data points). In view of the assumptions regarding the error term, in particular, the neglect of time-specific effects, cross-section approaches fail to capture the effect of periods of abnormal performance such as boom or bust cycles that may occur during the period covered by the regression. In turn, the disregard of country-specific effects may lead to a bias in the estimations due to the failure to take into account unobserved heterogeneity in the data. Besides, OLS yields consistent estimates of cross-section specifications only under quite restrictive conditions and our regression results have to be treated with caution.

[18] Note that the definitions of all variables in this regression are different from those when testing the conditional convergence hypothesis: instead of taking log differences for the period we take the period averages of these variables. The estimations cover the same period (2000-2011) and, obviously, they suffer even more from the same problem of low number of observations.

Table 3. Cross-section growth regressions for the EU-27 based on period average figures for 2000-2011 (OLS estimations). Dependent variable: average annual rate of growth of GDP per capita in 2000 PPS.

Variables (period averages)	Equations	1	2	3	4	5	6	7	8
Annual net inflow of FDI, % of GDP		0.093	0.179**	0.043	0.119	0.293***	0.419***	0.309***	0.345***
		1.451	2.636	(0.613)	(1.616)	(2.761)	(4.564)	(3.330)	(4.027)
Annual % change in real ULC		-0.579**	-0.652**			-1.363***	-1.436***	-0.741*	-0.784*
		-2.633	-2.671			(-3.870)	(-4.172)	(-1.910)	(-1.979)
Annual % change in the share in world exports		0.362***	0.355***	0.433***	0.441***				
		6.943	5.938	(8.439)	(7.626)				
Annual % change in (private debt as % of GDP)		0.152***		0.148***		0.248***		0.067	
		3.558		(3.037)		(3.302)		(0.703)	
Annual % change in total (government + private) debt as % of GDP)			0.155**		0.133*		0.298***		0.094
			2.713		(2.040)		(3.427)		(0.851)
Annual % change in total liabilities of the banking sector								0.159**	0.153**
								(2.631)	(2.557)
Constant		0.414	0.200	0.659*	0.563	-0.595	-1.084*	-1.362**	-1.500***
		1.382	0.508	(2.020)	(1.323)	(-1.215)	(-1.965)	(-2.633)	(-2.929)
Observations		23	23	23	23	23	23	23	23
R2		0.932	0.918	0.906	0.886	0.751	0.758	0.820	0.822
R2 adjusted		0.917	0.900	0.891	0.868	0.712	0.719	0.780	0.783

t-statistic in parentheses.

Some of these problems can be addressed by switching from a cross-section approach (cross-country growth regressions averaging growth over a period of time) to panel approaches based on annual data. Panel growth regressions can also be derived from conventional production functions in log form and linearising around the steady state. These models are also widely applied in the literature and can take different forms but in the main they are all variations of the following basic equation:

$$git = \lambda Zit + [\mu i + vt +] \varepsilon it , \quad (3)$$

where git is a measure of economic growth (usually taken as the growth rate of per capita real GDP) and Z is a vector of explanatory variables. The main difference compared to the growth regressions estimated in Table 3 above is related to the assumptions regarding the error term. These specifications typically include both country-specific (μi) and time-specific (vt) effects. Unlike the cross-section approaches (which ignore both these effects), such models make it possible to take into account the effect of periods of abnormal performance (e.g. by introducing time dummies) and to avoid an estimation bias due to unobserved heterogeneity (e.g. by using fixed effects techniques to account for unobserved country-specific effects). Switching to annual observations helps increase by a multiple factor the number of observations for estimating the regressions, thereby relieving the 'degrees-of-freedom problem' mentioned above.

More generally, panel estimations of equation (3) based on annual (rather than period average) data help address a number of the problems encountered in cross-section approaches. While none of the existing econometric techniques allows addressing all these problems at the same time, different techniques can deal with some problems on their own. Thus two-stage least squares (2SLS) or generalised least square (GLS) techniques with fixed effects take due care of country-specific effects. Applying instrumental variables can to some extent deal with endogeneity among the regressors. The generalised method of moments (GMM) technique applied to dynamic panel data models (Arellano and Bond, 1991) is considered even superior in dealing with endogeneity problems by instrumenting the first-differenced regressors with their corresponding values in levels, taking lags of two periods or more. However, when applied in first differences of the estimable dynamic panel model the latter eliminates time-invariant country-specific effects.

Tables 4 and 5 present two sets of estimation results of panel growth regressions (separately for GDP growth and GDP per capita growth), separately for the EU-27, EU-10 (NMS) and EU-17, both based on annual figures for the period 2000-2011 as follows: GLS estimations (Table 4) and GMM estimations (Table 5).

Before turning to the interpretation of the results, some methodological comments are in order. As in previous estimates, the vector of explanatory variables has been selected carefully to allow meaningful economic interpretation. As the specification of the growth regression is derived from a production function, variables that reflect the two main factor inputs were included: labour and capital. Labour input is represented by the number of employees while, for the lack of a better proxy, capital input is proxied by the level of gross fixed capital formation as a share in GDP.

The rest of the variables entering the growth regression are those that should in principle emulate the effect of technological progress or, in technical terms, the residual not explained by the variation in factor inputs. This aspect of the empirical analysis is in our view of greatest interest as it can provide insights into the driving forces of productive efficiency (in this case, total factor productivity) as a source of GDP growth. A wide range of variables were tested in these growth regressions and

those selected to be shown in Tables 4 and 5 are the ones that tended to be estimated as statistically significant.

Table 4. Panel growth regressions for the EU, 2000-2011, GLS estimations

Dependent variables: 1) annual rate of growth of real GDP (dY), %
2) annual rate of growth of real GDP per capita (dYpc), %

	dY			dYpc		
Variables	**EU-27**	**EU-10**	**EU-17**	**EU-27**	**EU-10**	**EU-17**
Annual change in total employment, %	0.703***	0.556***	0.586***	0.693***	0.539***	0.606***
	10.956	6.105	8.085	9.776	5.732	8.060
Gross fixed capital formation, % of GDP	0.140***	0.100	0.091*	0.090*	0.088	-0.032
	2.967	1.252	1.702	1.683	1.012	-0.578
Annual % change in real ULC	-0.277***	-0.114*	-0.399***	-0.284***	-0.163***	-0.402***
	-7.234	-1.918	-10.472	-7.260	-2.646	-10.246
Private credit flow, % of GDP	0.016***	0.062**	0.016***	0.016***	0.064**	0.017***
	5.793	2.047	6.259	6.297	2.011	6.383
General government balance, % of GDP	-0.023	0.239***	0.030	-0.053	0.190**	0.010
	-0.582	2.708	0.926	-1.281	2.141	0.305
Dummy, year 2008	-1.831***	-2.855***	-1.318***	-1.966***	-2.969***	-1.234***
	-6.981	-5.431	-5.725	-7.358	-5.398	-5.186
Dummy, year 2009	-4.435***	-8.535***	-2.790***	-4.699***	-9.156***	-2.924***
	-11.957	-12.959	-8.093	-12.116	-13.337	-8.316
Dummy, year 2011	-0.612**	-1.060*	-0.190	-0.853***	-1.333**	-0.438*
	-2.115	-1.877	-0.776	-2.792	-2.214	-1.729
Observations	285	109	176	285	109	176
R2 (weighted)	0.873	0.912	0.918	0.878	0.911	0.906
R2 adjusted (weighted)	0.855	0.895	0.904	0.861	0.893	0.891

Estimation method: GLS with fixed effects and cross-section weights. t-statistics are shown in parentheses.

Table 5. Panel growth regressions for the EU, 2000-2011, GMM estimations

Dependent variables: 1) annual rate of growth of real GDP (dY), %
2) annual rate of growth of real GDP per capita (dYpc), %

	dY			dYpc		
Variables	**EU-27**	**EU-10**	**EU-17**	**EU-27**	**EU-10**	**EU-17**
Annual change in total employment, %	0.678***	0.442***	0.587***	0.677***	0.444***	0.595***
	9.091	4.092	7.979	8.318	4.013	7.738
Gross fixed capital formation, % of GDP	0.218***	0.271**	0.110**	0.167***	0.268**	-0.009
	3.851	2.214	1.936	2.712	2.061	-0.161
Annual % change in real ULC	-0.250***	-0.148*	-0.383***	-0.243***	-0.200***	-0.374***
	-5.101	-1.929	-11.265	-4.672	-2.539	-10.278
Private credit flow, % of GDP	0.021***	0.035	0.017***	0.023***	0.042	0.019***
	5.234	0.898	13.817	5.216	1.030	12.785
General government balance, % of GDP	-0.078**	0.331***	0.008	-0.095**	0.214*	0.007
	-1.978	2.605	0.236	-2.196	1.719	0.219
Dummy, year 2008	-1.972***	-3.363***	-1.405***	-2.048***	-3.264***	-1.320***
	-7.275	-5.695	-7.298	-7.172	-5.640	-6.335
Dummy, year 2009	-4.688***	-8.664***	-2.982***	-4.859***	-9.077***	-3.048***
	-12.339	-13.727	-8.446	-12.085	-14.121	-8.307
Observations	258	99	159	258	99	159
S.E. of regression	1.903	2.075	1.162	2.005	2.242	1.241
J-statistic	189.817	80.851	119.873	190.702	82.420	119.179

Estimator: GMM estimator in first differences: Cross-section weights instrument weighting matrix; Cross-section weights standard errors and covariance. Instruments are second lags of independent variables. t-statistics are shown in parentheses.

The results presented in the tables were preceded by a number of tests. We tested hypotheses regarding the possibility of behavioural differences in the growth regression between different subsets of EU Member States, in particular, EU-10 and EU-17. For this purpose we estimated an equation in which, in addition to the basic specification, all variables are also interacted with a dummy for one of the sub-regions and checked the joint significance of the coefficients of these interacted variables through the Wald test (the null hypothesis in this case is that all coefficients of the interacted variables are jointly equal to zero). According to the results of this test, there is sufficient evidence to reject the null hypothesis of all the coefficients on the interacting variables being jointly equal to zero. Put in other words, this test suggests (as expected) that there are considerable behavioural differences between the two sub-regions, justifying the estimation of separate growth regressions for EU-10 and EU-17.

As discussed above and as seen in Tables 4 and 5, we use time-specific effects by including year dummies for years/periods of abnormal growth performance. The obvious candidates for such dummies are the years of the crisis, starting in 2008. As can be seen in Table 4, the coefficients of these dummies (for years 2008, 2009 and 2011) are estimated as highly statistically significant. In fact the tests for structural break do confirm that the year 2008 marks a break in the behavioural relation therefore meriting the estimation of separate equations for the years before and after the crisis. However, the length of this period is not sufficient for such panel estimations (especially as regards GMM which makes use of two-year lags). In fact, in the case of GMM, even when taking the whole period 2000-2011 (which is reduced to 2002-2011 due to the lagged instruments) the number of observations is not sufficient to include even the four year dummies applied in the case of GLS (we have therefore limited their number to two, only for the years 2008 and 2009).

In the main, the GLS and GMM estimation results are not much different from each other, confirming the same main directions of effects. There are, however, a couple of instances where there are some differences that need some attention in interpretation. Applying robust instrumental variables in the case of GMM to address endogeneity aspects provides more confidence in interpreting causal relationships in the regressions. Therefore we tend to give preference to the GMM estimates in cases their results differ from GLS.

Turning to the interpretation of these estimation results, and in line with the comments above, the panel growth regressions provide further insights into the growth performance of the EU in the past decade, in particular, allowing to disentangle, at least partly, the effects of the crisis. These results confirm that the crisis did take a heavy toll on the EU's growth performance: judging from the estimated values of the coefficients of the year dummies for the EU as a whole (EU-27), some 2 percentage points of foregone GDP growth in 2008 and some 4.5 percentage points in 2009 can be directly associated with the effects of the crisis. The coefficients on 'factor inputs' are generally in line with the priors with the value of the coefficient on labour inputs even estimated in a range close to the theoretical prior. For obvious reasons, the capital coefficient is less reliable, gross fixed capital formation being only a remote proxy for capital input.[19]

But for the purpose of our analysis, it is the coefficients of the remaining explanatory variables that provide more interesting insights. Two of these variables – the annual change in real ULC (international competitiveness) and private credit flow – were systematically estimated with statistically significant coefficients, suggesting that these two variables exerted a steady effect on the

[19] For example, regression estimates suggest that gross fixed capital formation in % of GDP affects positively GDP per capita growth in the EU-10 (NMS) but not in the EU-17 – see Table 5.

growth performance in the EU. These results re-confirm the conclusions already drawn in the previous econometric assessments, namely, that increased international competitiveness and rising private debt have been positively associated with GDP growth in the EU.[20] The fiscal balance variable was more volatile in the panel regressions: it was not always statistically significant and in different versions of the regressions was estimated with different signs.

Importantly, the panel growth regressions presented in Tables 4 and 5 also appear as the only analytical tool (among those tested so far) that makes it possible to clearly distinguish the differences in the growth behaviour between the subsets of EU Member States, namely, EU-10 (NMS) and EU-17. There were several distinctive differences in the patterns of growth of these aggregate groups of countries (EU-10 and EU-17):

- The one-off direct negative effects of the crisis on GDP growth were considerably stronger in the case of the EU-10 (NMS): some 3 and 9 percentage points loss of GDP in 2008 and 2009 respectively in the EU-10 compared to 1.5 and 3 percentage points, respectively, in the case of the EU-17 as suggested by highly significant dummy variables for these two years.
- In the period under consideration, international competitiveness (as reflected in the change in real ULC) was a more important factor driving (economic growth) productive efficiency in the subset of the EU-17 countries as compared to the EU-10 countries.[21]
- GLS and GMM estimates regarding the effect of private credit are not identical but, as mentioned before, we tend to give preference to GMM. In this sense, the panel regression tends to suggest that in the period under consideration, private credit was probably a more important productivity and growth driver in the case of the EU-17 as compared to the EU-10 where this variable was not significant in GMM estimates (Table 5).
- The relationship between the de facto fiscal stance and GDP growth was again notably different in the two subsets of countries. In particular, the panel regressions for the EU-10 (NMS) suggest a statistically significant positive association, whereas we did not identify statistically significant association in the case of the EU-17 (GMM estimator yields a negative association between government balance and GDP growth for the EU as a whole). As noted, the direction of causality in this case is ambiguous which calls for a more cautions reading of the results. It is also interesting to note the opposite signs of estimated coefficients for EU-27 and EU-10 in both GLS and GMM regressions (Table 4 and 5).

Conclusions and policy implications

The empirical assessment of economic convergence and growth undertaken in this paper provided important additional evidence of differentiated patterns in the NMS and the EU as a whole, both prior to and after the NMS' accession to the EU, in the lead-up to the current crisis and during the crisis. The empirical and econometric assessments presented above underline the considerable, sometimes increasing, heterogeneity of growth, pointing more generally to uneven economic convergence within the EU. This concerns not only the lasting differences between the NMS and EU-17 economies, but also significant dissimilarities between the growth patterns among individual

[20] The latter except for EU-10 (NMS), suggesting that private credit flows did not play a statistically significant role in NMS growth (see Table 5).

[21] As a word of caution, this conclusion need not be interpreted in the sense of understating the role of international competitiveness for productive efficiency in the EU-10. The above statement just indicates that the variation in productive efficiency in the EU-17 was to a higher degree associated with the variation in their international competitiveness.

countries within each of these subgroups (e.g. Hungary, Baltics, southern Europe versus North, etc.). This is clearly evidenced by the considerable within-group variation, sometimes growing over time, in various performance characteristics. The NMS economies – which are the main focus of this paper – are to some extent still a club of their own. This is evidenced both by the similarities of their performance characteristics and by the existing between-group variation in economic performance and growth compared to the rest of the EU. In particular, the econometric analysis based on panel growth regressions reported above provides further robust evidence as to the existence of important behavioural differences between the patterns of growth in NMS and the rest of the EU.

As a second general remark, we found that the absolute real convergence between the NMS and the remaining EU countries has continued (on average) without interruption before and during the crisis, albeit at a reduced speed in the latter period. In fact, as also evidenced in a number of related studies, this convergence process has been underway ever since the emergence of the NMS economies from the transformational recession that featured the start of their transition from plan to market at the beginning of the 1990s (World Bank, 2012). However, the assessment of individual growth patterns depends a lot on the selected time period and the particular convergence indicators. There is no unequivocal and straightforward conclusion regarding the convergence of individual NMS during the transition and EU membership periods. Moreover, the evidence for convergence provided in this paper is sometimes disputed by other authors (e.g. Podkaminer, 2013).

Panel growth regressions also suggest that private credit was positively associated with economic growth in the EU as a whole (but not in the NMS) during the past decade. While this outcome undoubtedly reflects realities, the irony is that due to the poor efficiency of financial intermediation, the ultimate outcomes were negative in both NMS and EU-17. At the same time, this outcome provides an additional piece of evidence for heterogeneity within the EU. Furthermore, the NMS were hit disproportionately hard by the crisis in both 2008 and 2009 as evidenced by higher values of (highly significant) dummy variables for each of these years.

The catching-up integration model of growth in EU-10 economies prior to the crisis was not much different from that in the EU-17, though there were some specifics in the NMS (Bruegel and wiiw, 2010). As seen by most of the empirical evidence presented earlier, apart from converging to per capita income levels, NMS economies were catching up/converging to the more developed EU Member States also in many important structural aspects of economic performance such as labour productivity, competitiveness, export performance, etc. In fact, the empirical evidence suggests that economic growth in the NMS was to a larger degree related to improvements in structural supply-side factors than this was the case in EU-17 economies. At the same time, the NMS have also mobilised considerable resources in their catch-up process. In relative terms (as a percentage of GDP) NMS economies attracted more FDI and more foreign savings in general than EU-17 economies and had higher fixed investment shares in GDP.

Empirical evidence on the economic performance of the EU countries in the period 2008-2011 also suggests a complete collapse of the growth model that prevailed before. This collapse may lead to additional arguments for critics of the so-called 'integration' growth model (Bruegel and wiiw, 2010; Podkaminer, 2013). Regrettably, in purely econometric terms, the time that has elapsed since the start of the crisis is still relatively short to try and estimate separate behavioural relationships for this period alone (for detailed empirical evidence and arguments see Podkaminer et al., 2012).

If one considers the issue of economic convergence related to NMS per se (in terms of reducing their per capita income gaps vis-à-vis the richer EU countries), the answer seems to be straightforward and

unequivocal: real convergence within the EU will continue as a fundamental long-term economic trend (see also World Bank, 2012).[22] As seen even in the recent crisis years, the NMS still maintained a positive growth differential vis-à-vis the EU-17. However, this was happening against the backdrop of a major downward shift in GDP growth rates across the whole EU.

Thus the key question now should be how to invigorate growth in the EU as a whole. Asking such a question regarding the NMS alone makes no economic sense, given their high level of integration in EU markets. While real convergence may still continue, it does make a difference if the catch-up process takes place at average annual GDP growth rates of more than 4% (as in the period 1995-2008) or if it happens at average annual GDP growth rates below 1% and the rest of the EU declining (as in the crisis period 2008-2012). As regards the growth prospects of the NMS, being part of the EU, they are subject to the same rules of the game and hence will not be spared the constraints that all EU economies are facing at the moment. Obviously, the NMS economies need to put behind them the model of resource-intensive, debt-intensive growth that they enjoyed during the past decade. This model has proved both ineffective and highly risky; besides, financial markets are not likely to engage as partners in such a model any longer. Given that NMS growth cannot be disentangled from that of the EU as a whole, it appears appropriate to identify factors related to EU growth in general (this is beyond the scope of the present paper; more on this see Bruegel and wiiw, 2010; World Bank 2012; Römisch, 2013).

Within the limits of tolerable future debt exposure, the question is how to re-shape the model of growth – or actually, how to shape a new growth model – that would invigorate growth in the NMS, apart from what needs to be done at the EU level. Being still a 'club of their own', there may also exist lines of policy-making that are specific for this group of countries. Obviously, one direction of possible policy measures is that targeting the supply side. Indeed, the NMS did fare better than EU-17 economies on this account during the past two decades as structural supply-side factors played a greater role in the NMS growth model. Among the important factors one should mention further advances in competitiveness (as reflected in unit labour costs) and in fostering innovation (supported by FDI inflows), two factors that did contribute to higher growth in these economies and which are likely to continue to have such an effect, if conditions are in place.[23]

Boosting competitiveness through ULC requires achieving a national (across party lines and tri-partite mechanisms), medium- to long-term consensus on aligning the dynamics of workers' pay with that of labour productivity. Those NMS countries that are not euro area members are in principle better placed to implement measures of this sort as they have at their disposal also the instruments of monetary and exchange rate policy (in practice, only Poland used these instruments in 2009). But as also demonstrated by the example of Germany, lasting ULC-based improvement in competitiveness can also be achieved within a monetary union (though not 'everybody can be like Germany' and the German 'model' itself is being disputed).[24] For Central European NMS (the Czech Republic, Hungary, Poland and Slovakia) the participation in German supply chain cluster led to technology transfer and accelerated income convergence while simultaneously increasing the exposure to fluctuations of final demand outside Europe (IMF, 2013).

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[22] Though this is sometimes disputed – see Podkaminer (2013).

[23] For obvious reasons, the discussion in this part is limited to factors that were part of the empirical analysis undertaken in the paper. This is by no means a claim that this is an exhaustive list of growth-enhancing supply-side measures. See World Bank (2012) for a discussion of additional growth-enhancing factors as well as Podkaminer (2013) and Römisch (2013) for alternative policy approaches.

[24] Posen, A. (2013), 'Germany is being crushed by its export obsession', Financial Times, August.

As regards the NMS countries, one of the empirical findings in the paper is that catching-up and absolute real convergence has been underway both before but also during the crisis. Economic growth in the NMS during the past two decades was also finance-dependent and debt-intensive but, on average, not to the extent observed in the average EU-17. The empirical analysis provided in the paper suggests that economic growth in the NMS economies was to a larger degree related to improvements in structural supply-side factors such as productivity, innovation, competitiveness, etc. – more than it was the case in the EU-17. At the same time, the NMS were hit disproportionately hard by the crisis. Overall, the paper concludes that real convergence with the EU will continue as a fundamental long-term economic trend, albeit with considerable differences among individual countries and probably at a lesser speed than before the crisis. The argument in the paper is, moreover, that while real convergence per se may continue even if EU growth remains sluggish, the pace at which the catch-up process takes place makes a huge difference both for the NMS economies and for the EU as a whole. It is therefore worth the effort to search for and pursue policies seeking to invigorate growth in Europe.

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Annex Table 1. GDP per capita at current PPPs (EUR), from 2012 at constant PPPs and population

	1991	1995	2000	2005	2008	2009	2010	2011	2012	2013	2014 Forecast	2015
Bulgaria	4400	4600	5400	8200	10900	10300	10700	11600	12100	12200	12400	12800
Croatia	7000	6700	9500	12800	15800	14500	14300	15200	15200	15000	15200	15500
Cyprus	10600	12800	16700	20900	24900	23500	23600	23700	23200	21200	20400	20800
Czech Republic	8800	11200	13500	17800	20200	19400	19500	20100	20500	20300	20600	21100
Estonia	5500	5300	8600	13900	17300	14700	15500	17500	18700	19100	19700	20400
Hungary	6800	7500	10300	14200	16000	15300	15900	16500	16500	16500	16700	17100
Latvia	6400	4600	6900	10800	14100	12000	12300	14700	16100	16600	17100	17700
Lithuania	7100	5200	7500	11900	15400	12900	14100	16600	18000	18600	19300	20100
Malta	9500	13100	16500	18100	20200	19800	21100	21500	22100	22400	22800	23300
Poland	4500	6200	9100	11500	14100	14200	15400	16200	17000	17200	17700	18300
Romania	4000	4800	5000	7900	11700	11100	11400	13300	13700	14000	14300	14600
Slovakia	5800	7000	9600	13500	18100	17100	17900	18500	19100	19300	19800	20400
Slovenia	8500	10900	15300	19700	22700	20400	20500	21000	20900	20200	20100	20300
NMS-13	5300	6500	8600	11800	14800	14200	14900	16000	16600	16700	17100	17600
Macedonia	4300	4000	5100	6600	8400	8500	8700	8900	8900	9000	9200	9400
Montenegro	.	.	5600	6900	10700	9700	10200	10500	10500	10600	10800	11100
Serbia	.	.	5000	7100	9000	8400	8500	8800	9000	9100	9300	9600
Turkey	3800	4400	8000	9500	11700	10900	12200	13100	13300	13800	14400	15100
Albania	1400	2000	3500	5200	7000	7200	7400	7600	8000	8300	8500	8800
Bosnia & Herzeg.	.	.	3900	5200	6500	6200	6400	6600	6700	6800	6900	7100
Kosovo	.	.	.	4400	5100	5000	5300	5600	6000	6200	6500	6800
Austria	18600	19700	25100	28200	31100	29400	31100	32400	33300	33500	34100	34800
Germany	18200	18900	22400	26100	29000	27000	29000	30300	31200	31300	31900	32500
Greece	12200	12300	16000	20400	23100	22100	21400	19900	19100	18300	18400	18800
Ireland	12400	15200	25100	32500	32700	30000	31000	32300	32900	33300	34000	34700
Italy	16900	17800	22400	23700	26100	24400	24700	25100	25100	24800	25000	25500
Portugal	10700	11300	15500	17900	19500	18800	19700	19500	19400	19000	19100	19500
Spain	12800	13400	18500	22900	25900	24200	24300	24700	24900	24500	24700	25200
USA	21400	23300	30600	35700	36700	34300	36000	37100	38600	39300	40300	41100
EU-28 average	13600	14600	18900	22400	24900	23400	24300	25100	25600	25600	26000	26500
					European Union (28) average = 100							
	1991	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Bulgaria	32	32	29	37	44	44	44	46	47	48	48	48
Croatia	51	46	50	57	63	62	59	61	59	59	58	58
Cyprus	78	88	88	93	100	100	97	94	91	83	78	78
Czech Republic	65	77	71	79	81	83	80	80	80	79	79	80
Estonia	40	36	46	62	69	63	64	70	73	75	76	77
Hungary	50	51	54	63	64	65	65	66	64	64	64	65
Latvia	47	32	37	48	57	51	51	59	63	65	66	67
Lithuania	52	36	40	53	62	55	58	66	70	73	74	76
Malta	70	90	87	81	81	85	87	86	86	88	88	88
Poland	33	42	48	51	57	61	63	65	66	67	68	69
Romania	29	33	26	35	47	47	47	53	54	55	55	55
Slovakia	43	48	51	60	73	73	74	74	75	75	76	77
Slovenia	63	75	81	88	91	87	84	84	82	79	77	77
NMS-13	39	45	46	53	59	61	61	64	65	65	66	66
Macedonia	32	27	27	29	34	36	36	35	35	35	35	35
Montenegro	.	.	30	31	43	41	42	42	41	41	42	42
Serbia	.	.	26	32	36	36	35	35	35	36	36	36
Turkey	28	30	42	42	47	47	50	52	52	54	55	57
Albania	10	14	19	23	28	31	30	30	31	32	33	33
Bosnia & Herzeg.	.	.	21	23	26	26	26	26	26	27	27	27
Kosovo	.	.	.	20	20	21	22	22	23	24	25	26
Austria	137	135	133	126	125	126	128	129	130	131	131	131
Germany	134	129	119	117	116	115	119	121	122	122	123	123
Greece	90	84	85	91	93	94	88	79	75	71	71	71
Ireland	91	104	133	145	131	128	128	129	129	130	131	131
Italy	124	122	119	106	105	104	102	100	98	97	96	96
Portugal	79	77	82	80	78	80	81	78	76	74	73	74
Spain	94	92	98	102	104	103	100	98	97	96	95	95
USA	157	160	162	159	147	147	148	148	151	154	155	155
EU-28 average	100	100	100	100	100	100	100	100	100	100	100	100

Note: From 2011 data may be affected by new population census data.

Source: wiiw Annual Database incorporating national and Eurostat statistics, wiiw estimates, Eurostat, EC – Spring Report 2013.